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(19) (CA) **CANADIAN PATENT** (12)

(54) STATIC DISCHARGE BULK CONTAINER

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No. OF CLAIMS 16

Canada

This invention relates to a bulk container, and more particularly, to a flexible bulk container made of fabric adapted to discharge static electricity.

Flexible bulk containers have been utilized for a number of years to transport and deliver finely divided solids such as cement, fertilizers, salt, sugar, and barite, among others. Such bulk containers can in fact be utilized for transporting almost any type of finely divided solid. The fabric from which they are constructed is a weave of a polyolefin, specifically, polypropylene or polyethylene, which may or may not receive a coating of a similar polyolefin. If such a coating is applied the fabric will be non-porous, while fabric without such coating will be porous. The usual configuration of such flexible bulk containers involves a rectilinear or cylindrical body having a wall, base, cover, and a closable spout secured to extend from the base or the cover or both. As shown in British Patent No. 1,129,917 and U.S. Patent No. 3,961,655, it is also known to place a surrounding flap or skirt around the spout extending from the base of the container.

Such containers are handled by placing the forks of forklift hoist means through loops attached to the container. The weight of such bulk container when loaded is usually between 500 pounds and 4,000 pounds, depending upon the density of the material being transported.

It has been found that the shifting of specific materials within the bulk container as well as friction created between the material and the container during loading and unloading of the container creates localized pockets of built-up static

electricity in the container.

The subject invention is a bulk container of rectilinear shape which is capable of dissipating static electricity from its surface so as to reduce the possibility of an explosion when discharge occurs near volatile gases or materials. The fabric utilized in the bulk container of the subject invention has parallel strands of conductive yarn extending therethrough, the strands being connected by grounded conductive connection means such that localized static electricity on the container is discharged. The fabric may be a weave of polyolefin filaments and carbon fibre, the carbon fibre acting as conductive yarn, the weave optionally being coated with polypropylene or polyethylene. The polyolefin filaments are preferably formed from polypropylene or polyethylene. The bulk container is constructed such that a pair of its opposite walls and the strands of conductive yarn in those walls are integral with the base, with a conductive collector strip extending around the line of joinder between those walls, the other two walls, and the cover. The strands of conductive yarn in spouts that connect to the base and cover of the container extend parallel to the longitudinal symmetric axis of the spouts. If the container has an outer flap or skirt extending around the spout connected to the base of the container, the flap or skirt is constructed such that the strands of conductive yarn extend longitudinally therethrough and parallel to the strands of conductive yarn in the concentric spout. A conductive collector strip extends along

the line of joinder between the base of the container and the spout that connects thereto as well as the outer flap or skirt that may also connect thereto. A grounding connection is attached to each of the conductive collector strips.

A preferred embodiment of the bulk container of the subject invention will next be described utilizing the accompanying drawings, in which:

Figure 1 is a perspective view of the bulk container of the subject invention, illustrating the components of the container.

Figure 2 is a side view of the bulk container of the subject invention illustrating the position of the conductive fibre yarns in the fabric of the container. Sections A, B, and C relate to details of the container construction which are amplified in Figures 7, 8, and 9, respectively.

Figure 3 is an end view of the bottom portion of the container illustrating the closable discharge spout of the container and the skirt surrounding that spout.

Figure 4 is an end view of the bottom of the container, as in Figure 3, but illustrating the discharge spout in the closed position with the skirt closed therearound.

Figure 5 is a side view of the bulk container of the subject invention while empty.

Figure 6 is a side view of the bulk container of the subject invention while loaded.

Figure 7 amplifies Section A of Figure 2 to illustrate the connection between the wall of the container and each

of the four lifting loop straps.

Figure 8 amplifies Section B of Figure 2 to illustrate the relative placement of the strands of conductive yarn in the weave of the container fabric.

Figure 9 amplifies Section C of Figure 2 to illustrate the conductive collector strips that extend along the joinder line between the wall and the cover of the container and the joinder line between the base of the container and the spout that connects thereto, and to illustrate the grounding loop connected to each such conductive collector strip.

As shown in Figure 1, the preferred embodiment of the bulk container is generally square in cross-section. One of the opposite pair of wall sections of the container and the base of the container are formed by a single main panel 20 to which are attached a pair of lateral panels 21, defining the opposite pair of wall sections of the container, and a top panel 22 defining the cover of the container. A filling spout 23 having a closure tie tape 24 extending therearound is connected at a central position to top panel 22.

As shown in Figures 2 and 7, a loop strap 25 is sewn into each upper corner of the bulk container, the two ends of each loop strap being stitched to adjacent upper corners of adjacent wall sections of the container. Webbing 26 extends along the line of joinder between the wall of the container and the cover panel of the container. At the upper corners of the container webbing 26 is also stitched to the loops 25 to provide improved strength to the container. A copper conductive braid 27 extends through webbing 26.

The bulk container is constructed of a woven fabric of polypropylene filaments and carbon fibres; in Figure 8, which represents Detail B of Figure 2, the polypropylene filaments are shown as thin intersecting lines and the carbon fibres are shown as heavy dashed lines. The carbon fibres extend longitudinally in the walls of the container such that one end of each carbon fibre in those walls contacts the copper conductive braid 27 in webbing 26, that braid also contacting the carbon fibres in top panel 22. One pair of opposite wall sections are integrally connected to the base section of the container to form main panel 20; carbon fibres extend longitudinally through main panel 20, i.e. down one wall section, through the base section, and up the opposite wall section. Filling spout 23 has carbon fibres woven therethrough so as to extend parallel to the symmetric longitudinal axis of spout 23. Although the line of joinder between filling spout 23 and top panel 22 does not have a copper conductive braid extending therealong, static electricity discharges from the carbon fibres of filler spout 23 into the carbon fibres in top panel 22 and then into the copper braid surrounding the outer perimeter of top panel 22. A tinned braided copper grounding loop 28 is connected to copper braid 27 such that a grounding cable connected to grounding loop 28 will remove static charge from the copper braid 27. The Detail C of Figure 2, which is shown in Figure 9, illustrates the connection of copper grounding loop 28 to copper braid 27.

A further length of copper braid 27 extends along the line of joinder between the base of the container and a discharge spout

29 which extends therefrom. A skirt 30 may also be connected to the latter line of joinder. The discharge spout 29 and the skirt 30 each have carbon fibres extending therethrough parallel to the symmetrical longitudinal axis of the spout and skirt; this allows discharge of static electricity through another grounding loop 28 which is connected to the further length of copper braid 27. The orientation of the carbon fibres in the woven polypropylene fabric is illustrated in Figure 2.

Discharge spout 29 and skirt 30 have closure tie tapes 31 extending therearound, each tie tape being fitted with a self-locking quick-release tension device 32. Figures 3 and 4 illustrate open and closed positions, respectively, of discharge spout 29 and skirt 30; in particular, Figure 4 illustrates a closed discharge spout 29 positioned inside of a closed skirt 30.

Figures 5 and 6 illustrate generally the side profile of the bulk container while empty and during discharge, respectively; "X" indicates the sling effect of the bulk container which ensures a constant-flow, total discharge of the materials from the container. This sling effect results because one of the pair of opposite wall sections of the container and the base of the container are formed from a continuous length of the woven fabric, i.e. main panel 20 in Figure 1.

Electrical discharge tests have been conducted on the type of bulk container herein described. It has been found that when the subject container is properly grounded static electrical charges in the container were reduced to less than

500 volts, whereas prior to grounding voltages in excess of 1,000 volts were registered. Powdery material is thus more safely handled by the bulk container of the subject invention in gaseous and volatile environments than by conventional bulk containers which do not have static electricity discharge capability.

CLAIMS

1. A container comprising a wall, a base, and a cover, means connected to the cover for filling the container, and means connected to the base for emptying the container, the container being constructed of fabric having strands of conductive yarn extending therethrough, the strands being connected by conductive connecting means adapted to be grounded, such that localized static electricity in the container discharges to ground.

2. The container of claim 1, wherein the means connected to the base for emptying the container is a flexible tube having a releasable closure means.

3. The container of claim 2, and further comprising a releasable skirt means attached to the base so as to concentrically surround the flexible tube when the tube extends from the base.

4. The container of claim 1, wherein the means connected to the cover for filling the container and the means connected to the base for emptying the container are each a flexible tube having a releasable closure means.

5. The container of claim 1, wherein the fabric is a woven polyolefin.

6. The container of claim 5, wherein the polyolefin is polypropylene.

7. The container of claim 5, wherein the polyolefin is polyethylene.

8. The container of claim 1, wherein the conductive yarn is carbon fibre.

9. The container of claim 1, wherein the conductive connection means is a copper braid.

10. The container of claim 1, wherein a pair of opposite sides of the wall are integrally connected to the base, the strands of conductive yarn extend integrally in those sides of the wall and in the base, such strands contacting a conductive connecting means extending along the line of joinder between the wall and the cover, the strands in the other pair of opposite sides of the wall also contacting that conductive connecting means.

11. The container of claim 2, wherein the strands of conductive yarn extend through the fabric of the flexible tube such that one end of each strand contacts a conductive connecting means extending along the line of joinder between the tube and the base, a portion of the strands of the conductive yarn that extend through the base also contacting that conductive connecting means.

12. The container of claim 11, and further comprising a releasable skirt means attached to the base so as to concentrically surround the flexible tube when the tube extends from the base, the strands of conductive yarn extending through the fabric of the skirt means such that one end of each strand contacts a conductive connecting means extending along the line of joinder between the skirt means and the base, a portion of the strands of the conductive yarn that extend through the base also contacting that conductive connecting means.

13. The container of claim 12, wherein the strands of conductive yarn extending through the skirt means and the strands of conductive yarn extending through the flexible tube contact the same conductive connecting means.

14. The container of claim 1 when generally square in cross-section.

15. The container of claim 2, wherein the flexible tube is generally circular in cross-section, a first frustro-conical portion of the tube having its larger end connected to the base and a second cylindrical portion of the tube having one of its ends connected to the smaller end of the frustro-conical portion.

16. The container of claim 1, wherein the fabric is a weave comprising polypropylene filaments and carbon fibres and having a coating of polypropylene.

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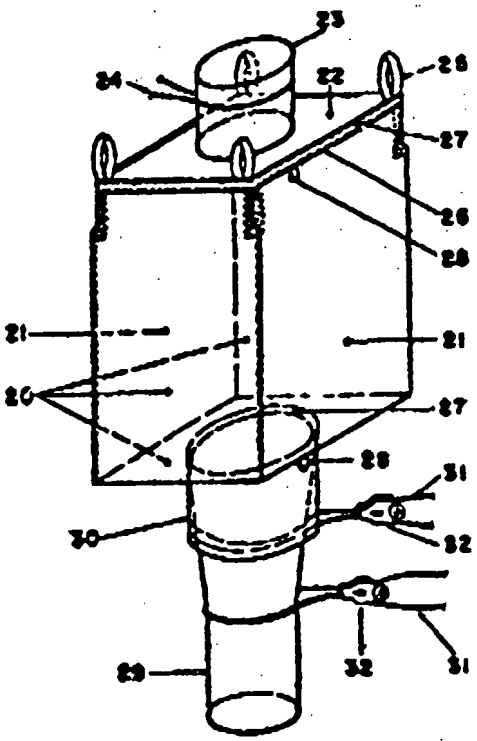

FIG. 1

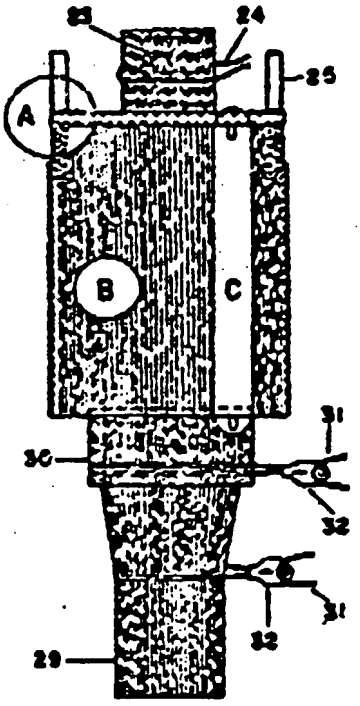

FIG. 2

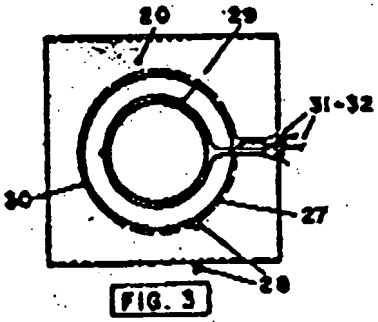

FIG. 3

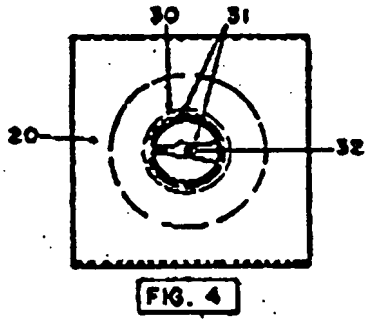

FIG. 4

Gowling & Henderson

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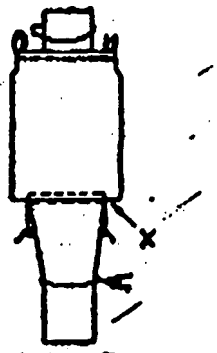

FIG. 5

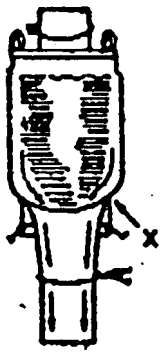

FIG. 6

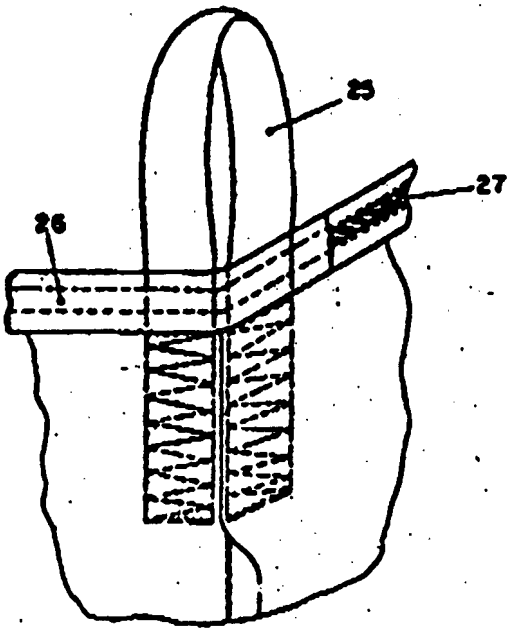

FIG. 7

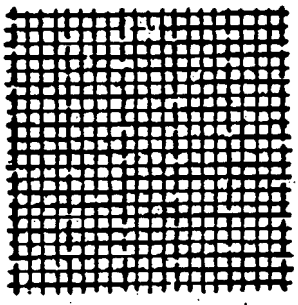

FIG. 8

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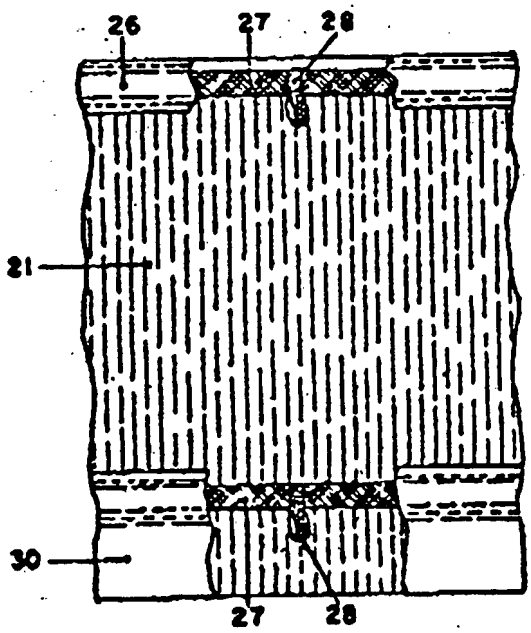

FIG. 9

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